A Work Project presented as part of the requirements for the Award of a Masters Degree in Finance from the NOVA - School of Business and Economics.

A STRATEGIC RECOMMENDATION TO MARKET AND LAUNCH A NEW VICHY PRODUCT OF THE NEOGENIC CATEGORY.

PRODUCT LAUNCH AS AN INVESTMENT OPPORTUNITY.

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A Project carried out as a part of the Business Project, under the supervision of:

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ABSTRACT

The Business Project was centered on the launch of a Vichy Dercos Neogenic product and two main issues were addressed. Firstly, the group conducted a Market Analysis and a Target Definition exercise, bearing in mind the possible cannibalization effect on revenues of previous products. Secondly, a 360º Launch Strategy was devised, focusing on every touchpoint of the consumer journey. Within the scope of this Work Project, the product innovation process conducted by Vichy was framed as an investment opportunity incorporating real options and accounting for technological and market uncertainty, leading to a more accurate Net Present Value of the project.

Key Words: Target Definition, Launch Strategy, Investment Opportunity, Real Option

TABLE OF CONTENTS

1. THE BUSINESS PROJECT – DESCRIPTION AND CHALLENGE

a. L'ORÉAL GROUP

A French cosmetics company operating in 130 countries, L'Oréal is the irrefutable global market leader when it comes to beauty care. Founded in 1909 by Eugène Schueller, it experienced a period of fantastic growth due to strategic acquisitions and international expansion between 1957 and 1983. During this period, L'Oréal created emblematic products such as Elnett and Kérastase. It also acquired Lâncome, Garnier, Biotherm and Vichy. There are five divisions: L'Oréal Luxe (Cacharel, YSL Beauté, Ralph Lauren Fragrances, etc.), Active Cosmetics (Vichy, La Roche-Posay, SkinCeuticals, etc.), Consumer Products (L'Oréal Paris, Maybelline New York, Garnier, etc.), The Body Shop and Professional Products (L'Oréal Professionnel, Kérastase, Redken, etc.). In 2014, the Group had consolidated sales of 22.53 billion euro and the Active Cosmetics division sold 1,660.4 million euro with 77.5% of these sales being related to skincare products and the majority being attributable to Vichy.

b. VICHY

Vichy is a city in the center of France which is globally known for its mineral-rich, Thermal Spa Water. Back in 1931, Dr. Prosper Haller, a medical director at the thermal treatment center in that same city uncovered the therapeutic virtues of Vichy Thermal Spa Water on the skin – such as improving skin quality, soothing sensitivity and accelerating wound healing. Convinced of having found a business idea with tremendous potential, Dr. Haller created the first line of skincare cosmetics, having Vichy Thermal Spa Water at the core of every formulation.

From then on, Vichy has always been at the forefront of innovation, heavily investing in R&D and combining the idea of beauty care intrinsically with that of healthcare, creating a unique value proposition that is still strongly embedded in the brand. Even though the main focus of the brand is skincare, other products exist within the beauty and healthcare sectors. The brand's products are mostly sold in pharmacies, a fact that motivated L'Oréal to start cooperating with Vichy in 1954, granting the beauty care giant a better control of this specific distribution channel. L'Oréal integrated Vichy in its brand portfolio definitively in 1980.

c. Current Client Situation – Vichy Italia and Dercos Neogenic

In Italy and as of 2014, L'Oréal's Active Cosmetics Division was leading the dermocosmetics industry with 14.3% market share, placing itself ahead of Pierre Fabre (10.5%) or Bionike (6.1%). More specifically, Vichy Italia presented in the last year a turnover of 60 million euro and it was the leader in pharmacy sales, having an 8.4% market share and boasting its image as a "healthy chic" pharmacy brand. One of the strategic markets within which Vichy Italia operates is the anti-hair loss business. Overall, this industry represents a 90 million euro turnover in Italy, whereas 50 million are obtained through pharmacies and 30.2 million through hair salons. In order to tackle this important market, Vichy has created two Dercos product lines.

On one hand, there is Dercos Aminexil Pro, which is sold in two gender-differentiated versions of 30 ampoules at a price of 81 euro. For intensive action, one ampoule per day must be applied on the scalp and must be distributed evenly, during 10 minutes, leaving it to take effect without rinsing. Dercos Aminexil Pro is designed to tackle seasonal hair loss and to accelerate stronger hair growth.

On the other hand, Dercos Neogenic is sold as a pack of 28 ampoules, which costs 99,90 euro and the consumer must use an ampoule per day, every day, during 3 consecutive months. Upon placing the product on one's scalp, it is then necessary to massage it so that the product gets absorbed. This process takes around 10 minutes. Vichy communicates abundantly that this product does not cure severe baldness but helps in stimulating hair growth by awakening bulbs which have been dormant.

d. The Business Project Challenge

Within this context, the challenge that was presented to the group was to develop strategic recommendations to position, launch and sell a new version of the Dercos Neogenic category without cannibalizing the sales of the existing product.

2. Reflection on the Work Done

a. Problem Definition

In the past year, the anti-hair loss market has been shrinking due to the economic crisis and the damaged credibility of the products. This has affected the top three industry

players – Vichy, Giuliani and Idi. In the first semester of 2015, Vichy sought to restore the credibility back to the market, creating the first national hair and scalp health prevention campaign, where customers would go to one of the 3,000 pharmacies involved and would get a free check-up.

Vichy then started pondering its next steps, specifically regarding its Dercos Neogenic product. Through a survey made in the Italian, French and Spanish markets, the company found out that the main issues of its product were that 60% of people stop the treatment before completion (3 months), 39% think it is too expensive, 26% say the results are not visible and 18% say that the product is not practical. Vichy also believed that by solving the latter three problems, it could solve the issue of treatment abandonment. To address the price issue, the company was creating a loyalty card and to tackle the problem of results lacking, Vichy was committed to better targeting its consumers and to create a 3 months coaching motivation mechanism.

However, the practicality of usage was still a challenge. The key consumer insights regarding this issue were that the application time was too long (24%) and that it made the hair too wet (10%), being even more problematic when applied in the morning (which was what 37% of the consumers did). So in this case, the solution that Vichy adopted was to launch a gel-fluid version of the Dercos Neogenic product, as opposed to the existing liquid format.

Bearing all of the above in mind, the task that Vichy assigned to the group required answers to three key points. First, it was necessary to deeply understand what positioning to give to this new product and who to target. Secondly, it was essential to take into consideration the possible cannibalization of revenues of the existing Dercos Neogenic product and to make plans to minimize this effect. Finally, Vichy required a 360º launch strategy, with recommendations for all possible customer touchpoints.

b. Methodology of the Business Project

i. Hypothesis and Initial Considerations

At the center of this Business Project was the hypothesis that launching a new gel-fluid Dercos Neogenic would lead to increased practicality of usage of the product and consequent consumer satisfaction, complementarity with the existing product – which could lead to improved targeting –, a decrease in the abandonment rate of treatments, a

rise of visible results and, finally, larger sales revenues from increased referrals and augmented credibility. Vichy therefore saw the launch of the new product as a cornerstone in its strategy for turning around the anti-hair loss product and that was exactly what needed to be done through this launch.

In terms of the considerations that were needed to kick-off the Business Project, there were four essential ones that were discussed with Vichy and were taken as a given throughout the entirety of the project. Firstly, given the strategic importance of the product launch at hand, Vichy stated that there were to be no budget constraints on this project. Even though Vichy had a number in mind, the company did not wish to disclose it. However, the company did say that the budgeted values were very high given the potential that the launch had to grow the market and the intrinsic profitability of the anti-hair loss market and of its Dercos product line. This gave way for all creative and effective ideas to be presented, regardless of their cost of implementation.

Secondly, Vichy stated that it would give no further information to the group regarding market analysis, consumer insights or their beliefs in terms of who to target for the new gel-fluid Dercos Neogenic. With this measure, the company aimed to have a Business Project that was totally unbiased by Vichy's generalized opinion, opening a door for views which might be simultaneously different from theirs and more adequate.

Thirdly, the group was told that the target which was previously assigned to the existing Dercos Neogenic product was merely defined as "those who experience hair thinning and receding hairlines". No further specifications regarding demographic or psychographic factors were made, creating a very disperse customer base. Therefore, if the gel-fluid version was to be launched and properly targeted, the Business Project would also have to suggest a repositioning of the liquid version, so as to not confuse consumers and to minimize cannibalization.

Finally, it was necessary to perfectly grasp the differences between the two Dercos Neogenic versions. Both products have the exact same efficacy. The only difference concerns the application method. However, it is necessary to communicate this to consumers, avoiding that they believe the gel-fluid product to be an updated and improved version of the liquid product.

ii. Work Plan and Project Structure

Upon discussing with Vichy and the Academic Advisor, Professor Emanuela Prandelli, a clear-cut approach was designed in order to better proceed with the Business Project. The group would start by focusing on coming up with an ideal positioning for the new product, recurring to any kind of analysis that it deemed necessary. After having extracted relevant conclusions from this analysis, an intermediate meeting and presentation would be held halfway along the semester between all involved parties to present the findings, get feedback from Vichy on the quality of the work and the target choice and approval to keep working on this target or to keep searching for a better one.

After getting the approval, the group would then delve into the details of creating the 360º launch strategy with the most innovative ideas possible while keeping the end goals of the Business Project in mind. The work plan would then culminate with a final presentation where the launch strategy would be explained to Vichy in detail, clarifying the reason behind every action and how and when each of them should take place.

iii. Analysis

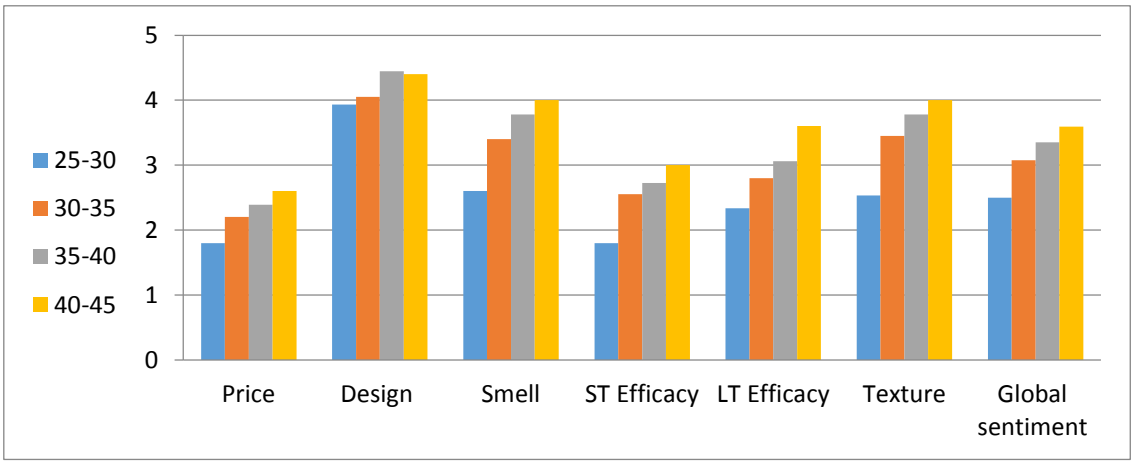
1. Market Analysis and Target Definition

In order to better understand the anti-hair loss market and to be able to decide on the best possible positioning for the new gel-fluid Dercos Neogenic product, the group decided to adopt a methodology based on the analysis of three different dimensions or stakeholder groups: Consumers, Competitors and Distributors.

Regarding the Consumer Analysis, three different methods were employed. Firstly, by using online tools such as SocialMention or Google Blog Search, consumers' opinions about Dercos Neogenic could be grouped and analyzed but none of the tools proved to be too effective in providing enough data to extract valuable conclusions from. The second method used was the analysis of Dercos Neogenic feedback on Beauté Test, an online database where French consumers write their reviews about beauty and health care products, describing strengths and weaknesses and rating each product characteristics, as well as leaving some of their demographic data.

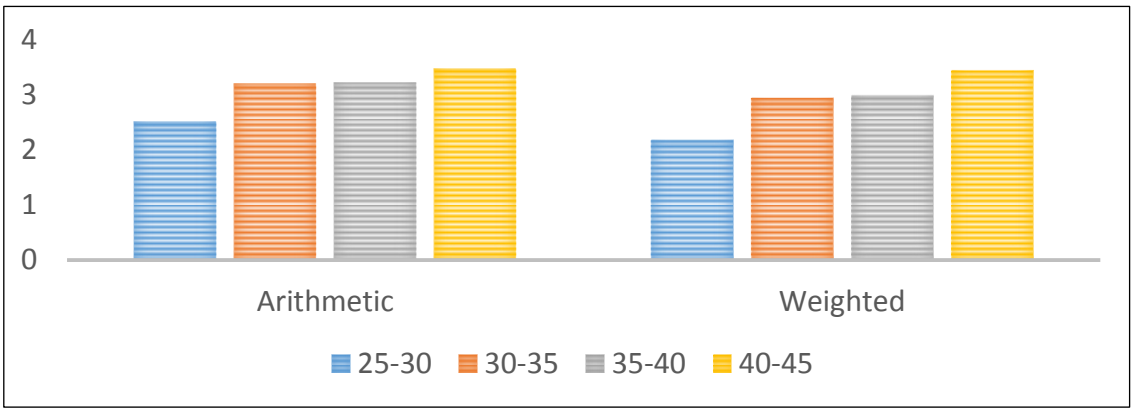
Resorting to this database of 94 observations at the time of the analysis and removing all extreme observations – ratings of 5 stars or 1 star to every single characteristic – and collecting all the data in a table, it was possible to extract some conclusions.

Since women in age ranges between 25 and 45 years old are the most abundant population in this sample (54.25%), it was assumed that all results extracted from this subset of the data would be closer to statistical significance, even if these subsamples were still too small to approach their distribution to a normal one. An interesting result was that older women seem to be, overall, more satisfied with the product.



Graph 1 – Beauté Test Ratings (BTR): Women Aged 25- 45

Even when focusing strictly on Global Sentiment and creating a weighted average, accounting for several hypotheses, such as changing price sensitivity and evolving appreciation for different product features such as texture and smell, this difference seemed to persist.



Graph 2 – BTR: Women Aged 25- 45, Arithmetic vs Weighted Average

A final and particularly important result extracted from this database was the fact that 21.3% of the entire sample were actually complaining that the product was "too liquid" and 85% of those complaints were coming from women between 25 and 50 years old. Even if these five age ranges of women represent 60.64% of the entire sample, it can be seen that they become an even more relevant group when it comes to complaining about the texture of Dercos Neogenic.

The last method employed was the analysis of the TRND Italian Panel with 500 consumers being chosen to try the product for free during 3 months. Besides the fact that consumers were satisfied with the product, the most important insight was that most consumers used Dercos Neogenic in the evening, before going to bed.

Going on to the Competitors Analysis, the group decided to investigate which solutions for permanent hair loss were available in the Italian market. There were two main competitors: Bioscalin and Phyto. Both had two different product lines for addressing this issue, targeted by gender: Bioscalin Intensiv and Phyto's Phytolium for men and Bioscalin Tricoage+ and Phyto's Phytocyane for women. It was also clear that competitors had three different product categories: Vials (such as the existing Dercos Neogenic), Shampoos and Oral Complements. Vials are seen as the most effective method, but also the most expensive, by consumers. Oral complements, on the other hand, seem to have a better quality/price relationship, at least in the eyes of the consumers, and are therefore often preferred to vials.

Finally, concerning the Distributors Analysis, the group chose two distinct methods to gather insights. Firstly, face-to-face interviews with 16 different pharmacies in Como and Milan were performed to understand the customers' attitude towards anti-hair loss products, the pharmacists' perception of Dercos' strengths and weaknesses and their opinions regarding the gel solution. During these interviews, the pharmacists agreed that customers who finalized the purchase are committed with finishing the treatment. However, many potential clients are lost due to the high price of the product and the complexity and invasiveness of the treatment. The gel-fluid version of Dercos Neogenic would address this second issue, but pharmacists showed some skepticism regarding this new format, stating that Vichy would have to clearly communicate the benefits of the product and to debunk some beliefs such as that of the gel making hair greasier.

On the other hand, a mystery shopping activity was developed, targeting 12 other pharmacies in Milan and Ancona, to identify the results of the existing training sessions that Vichy held for pharmacists regarding its anti-hair loss products, grasping how much they knew about the product. The group discovered that less than half of the pharmacies were aware of the right purpose of Neogenic. These pharmacies were also the only ones who knew the dosage. Nevertheless, all of them were sure of the quality of Neogenic.

Taking into consideration the three analyses and its results, it was possible to extract some conclusions that allowed the group to identify what would be the ideal target for the new Vichy Dercos Neogenic product and how to reposition the existing product.

2. 360º Launch Strategy

Concerning the Launch Strategy, there was a set of challenges to be addressed. These challenges, specific to the new Dercos Neogenic product launch were to avoid cannibalization, to increase awareness and perceived added value, to tackle the invasiveness issue, to fight skepticism regarding the gel version and to increase customer retention by recommending the right treatment.

c. CONCLUSIONS AND RECOMMENDATIONS

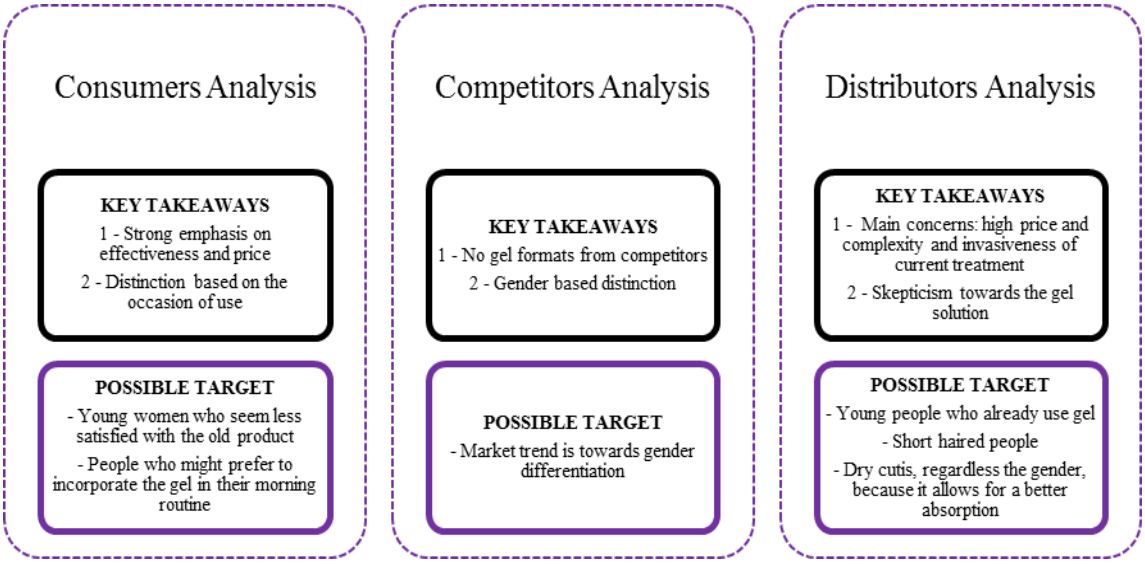


Figure 1 – Market Analysis Takeaways and Possible Targets

Taking into consideration the analyses performed, there were several key takeaways extracted, which were then fundamental for the target definition exercise, as shown above. Hence, the target population for the new gel-fluid format was defined as "active timesavers, professional people on-the-go, who prefer easier and quicker solutions and who have dry cutis". This lead the group to reposition the existing liquid format product towards a target that included older men and women who are less active and have a fatter cutis. Also, the group decided to differentiate the products based on the occasion of use – Dercos Neogenic liquid would be dedicated to a more relaxed evening beauty routine and Dercos Neogenic gel-fluid being associated to the morning routine.

In considering the launch strategy, it is necessary to communicate on both products and to highlight the different occasions of use and application, while stressing the exact same efficacy. Also, the 360º launch strategy was divided into six key issues and recommendations: Pharma (Distributors) Strategy, Public Relations Event, Media Strategy, Pop-up Stores, In-Pharmacy Experience and the Mobile App.

The developed Pharma Strategy focused on recommendations for educating pharmacists and for restructuring their incentive system. On the first point, the group developed an innovative training day, starting with a presentation about all the products of the Dercos category, highlighting its virtues and differences. Afterwards, a gamification element was introduced – "MillionHair" – which would be used as a way to check pharmacists' knowledge of the product mixed with fun hair trivia, with the best performers being rewarded. The day would continue with a Discovery session with different booths where pharmacists could get to know the Dercos App, try the gel-fluid product themselves and be convinced of the texture of the new version or ask specific questions about their issues with the product. Finally, the day would conclude with a networking dinner consisting of food that improves hair health such as fish, eggs, chicken and spices like cumin or black pepper. On the restructuring of the incentive system for pharmacists, the main goal is to motivate more accurate product recommendations, higher customer satisfaction and lower treatment abandonment rate. This would be done by introducing Dercos Points with a multiplier effect (e.g. 100 points for a single package sold and 600 points for a complete treatment of 3 packages sold to the same customer) which pharmacists could then exchange for rewards. The Dercos Points system would allow, as a side effect, the tracking of each individual client's purchase history and a more comprehensive customer database.

In terms of the Public Relations Event, it should be targeted to key opinion leaders such as press agents, beauty bloggers and medical experts, achieving mentions in press and online and increasing awareness of the Dercos product line. The event would start with a molecular cuisine lunch, going on to a presentation, a hair diagnosis of the guests with the recommendation of a Dercos product, a "show house" reflecting the two sided story of two different occasions of use, two different products and one standard of excellent efficacy. Then, the guests would go to the "hairdresser corner" where they would be given a free haircut and styling with L'Oréal products, before finishing the night off

with a party in La Rotonda della Besana in Milan, where the guests would be joined by the partner pharmacists (i.e. the ones who attended the training day).

Regarding the Media Strategy, there would be more targeted advertising for the gel-fluid version and a broader one for showing the double-sided story.

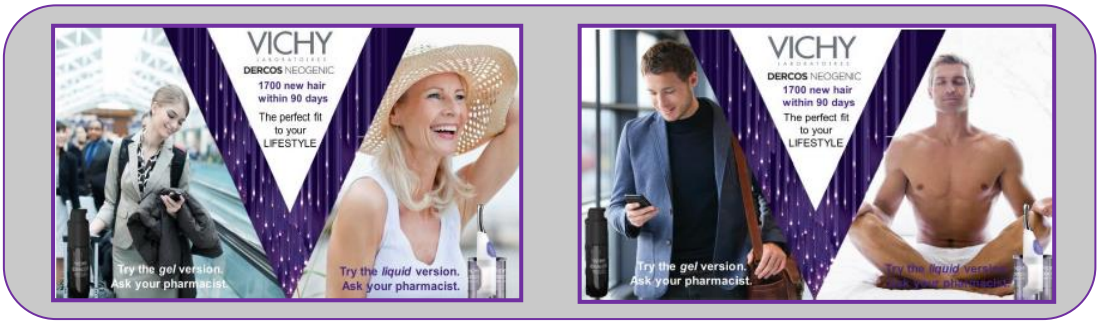


Figure 2 – Outdoor Advertising with Two Sided Story – Men and Women versions

In addition, an interactive advertising through digital channels would be created, very similar to that of Honda Civic Type R, where viewers can click "R" on the keyboard to change between the sides of the double-sided, parallel story.

Concerning Pop-Up Stores, these would be located in places such as airports and train stations, as well as city centers, locations which are highly frequented by young professionals on the go. The group displayed how the interior would be laid out, including blueprints, 3D simulations and "traffic-generation mirrors" – mirrors in the bathroom of airports and train stations with the message: "Stressed hair? Come and visit us at the Vichy stand for a free head massage!".

Regarding the In-Pharmacy Experience, new eye catching windows and stand-alone units were created to still reflect the two-sided story. Furthermore a tablet in those units, that is already present at Vichy's partner pharmacies, would give customers the possibility to complete a quiz, which the group created in order to understand what is the adequate product of the Dercos category for each individual consumer, granting personalized service to clients and ensuring the best probability of customer retention.

Finally, the Mobile App was the solution that the group found in order to drive customer engagement with the product category. Most Vichy online channels are heavily underused by consumers (i.e. blog, website, MyIdealSkin, etc.) and the ones which are used are extremely tough to control and may have negative effects on the product and brand (i.e. Facebook). Therefore, a closed environment such as an app would be ideal for Vichy, constituting an added value for consumers and hopefully

increasing their willingness to pay for products of the Dercos category. The Dercos app would help in motivating customers to finish their three months treatment, in engaging them through additional features such as health or diet tips, in supporting customers by providing them with a communication platform to get in touch with other customers, pharmacists or L'Oréal experts and in supporting pharmacists through the possibility of tracking individual consumer behavior.

If all of the abovementioned measures are implemented, the group is certain that the momentum of the launch campaign will be maximized and that its effects will extend to the entire Dercos product line, resulting in a larger sales volume for Dercos in Italy and an increase in satisfaction of the customer base.

d. IMPLEMENTATION AND CONCERNS

Even though it was outside of the scope of the Business Project, the group decided on a timeline of events, to map the implementation of the previously mentioned measures.

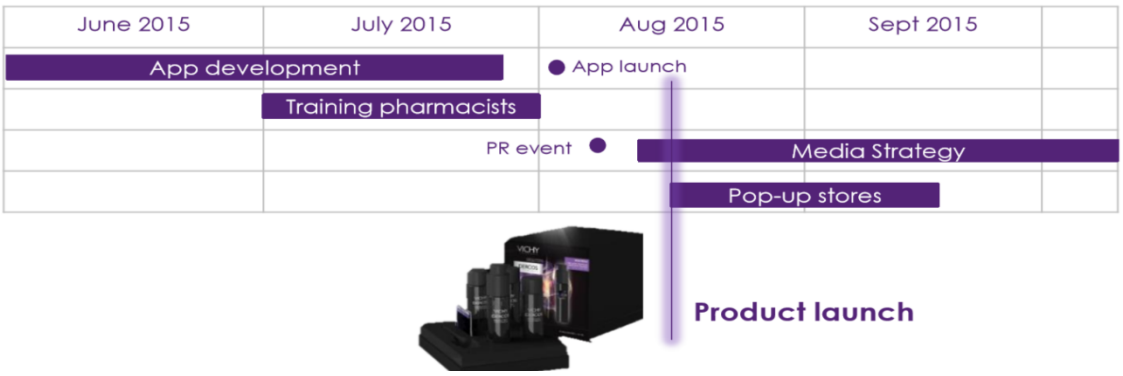


Figure 3 – GANTT chart with main events of the product launch

Regarding concerns, the first one shared by the group was the launch date. Would an August launch be the best timing for this product? Although this campaign would allow Vichy to increase the awareness of consumers about its seasonal product, Dercos Aminexil Pro, that had a sales spike every year around the Autumn months, it would also impact customers at a time when they are more disconnected from their problems and their daily lives, spending a lot of their time and money on holidays. Even when confronted with this, Vichy was not convinced to back down from their launch date.

Another concern of this Business Project arose regarding the budgeting of the Launch strategy. Although it happened due to the mandate of the Business Project itself, all of the measures created for the Launch strategy were only subjected to a test of actual feasibility and not weighed against their possible costs. In this sense, the strategy was

created in a "utopic" scenario where there are no budget constraints. Given that the more realistic case suggests that there are indeed limits to Vichy's budget and availability to pay, the group decided to come up with a priority list of measures, suggesting what is essential for the strategy and what is less important if the budget cannot accommodate all of the initiatives.

Much unlike other L'Oréal products, since Dercos Neogenic only sells in pharmacies, the group listed the Pharma Strategy and the In-Pharmacy Experience as the fundamental pieces of this strategy. After properly funding these two aspects, Vichy should address the Mobile App, given the game-changing possibilities it confers to the entire Dercos product line. All other initiatives, regarding the Media campaign, the PR Event and the Pop-Up Stores, are at the bottom of the priority list given that these activities are mostly focused on increasing brand awareness and have the least direct effect on sales. Upon being presented this priority list, managers were still confident that it would be possible to implement all discussed initiatives.

The main shortcoming of the Launch strategy devised was the lack of information provided by Vichy to restructure the incentive scheme. Therefore, the recommended incentive scheme was built as an add-on to the existing one and without knowing what is currently being done. With this said, the presented measures seem to be adequate almost independently of the underlying (currently active) pharmacy incentive scheme. According to Vichy, all the suggestions made on this are reasonable and of easy implementation on top of the existing scheme.

3. PRODUCT LAUNCH AS AN INVESTMENT OPPORTUNITY

a. THEORETICAL FRAMEWORK – NPV AND REAL OPTIONS

Whenever a company identifies an investment opportunity, it calculates the project's Net Present Value, to judge if it is worth pursuing. Much unlike shares or bonds, business investment opportunities are not passive investments and its associated cash flows can therefore be influenced by managers' decisions. These decisions can modify the projects themselves to take advantage of new opportunities or respond to new problems, and impact said cash flows, constituting what is known as a "real option". Hence, calculating only the NPV of that opportunity constitutes an over simplification of the business environment. It does not capture uncertainty, which, as John Allen

Paulos once said, is the only certainty there is. The true value of the business investment opportunities is better characterized as the aggregation of the "static" NPV and of the real options of modifying the project somewhere along the way.

These decisions throughout the project are often known as "real" options because they refer to tangible assets, as opposed to options as derivatives, referring to financial instruments. Some examples of real options are the "option to delay", "option to expand", "option to abandon", "option to pursue M&A", etc.

These examples can easily be applied to decisions which managers have to make when a new product's innovation and launch is analyzed as being an investment opportunity. Depending on the degree of complexity that one wants to give the analysis, multiple nodes or decision points can be identified, which are the points in time when managers' choices can affect the project's cash flows. This degree of complexity must be chosen by understanding the trade-off between increasing "generality" and "accuracy" and consuming too much time with this analysis, much like what Thorngate's postulate of commensurate complexity says on theories of social behavior.

b. PRODUCT INNOVATION AND LAUNCH – INVESTMENT TIMELINE

There are four general stages that must be considered throughout the project, each of which with the possibility of having several real options embedded.

Firstly, in order to have a new product in the market, a company must engage in "New Idea Generation", to come up with ideas that may have sufficient demand in the market to justify the investment. In this stage, the investment is small and cash outflows are focused on sustaining the operations of the team which is working on the idea generation. No cash inflows from this project take place in this phase.

The second stage can be designated as "Research". During this phase, scientists and researchers test the concept in theoretical terms and uncover how to better translate the idea into a minimum viable product that can be marketed. At this point, the cash outflows are related to the actual research and are significantly larger than during the previous stage. Once again, no cash inflows exist at this point in time.

Thirdly, a company then proceeds to the "Development" phase, where the researched concepts are then tested for practical feasibility and cost feasibility and are given form and function, prior to being fully ready to market. Cash outflows are even more relevant

at this point and include experimentation, analysis and prototyping. In this stage, the company still has no sales and, therefore, no cash inflows.

At last, the project goes into the "Launch" stage. During this period, the company has cash outflows which are directly linked to its Launch campaign. Also, the product starts selling for the first time and, as a consequence, represents cash inflows for the company. The discounted cash inflows for the sale of the product are to outweigh the outflows throughout all four stages if the entire project is to have a positive Net Present Value. In addition and as mentioned above, real options of abandoning the project or changing it must be considered if the project is to be accurately valued.

All of the four stages can be applied to the product at hand and, with this in mind, it becomes easier to map Vichy Dercos Neogenic's gel-fluid product innovation and launch as an investment opportunity with embedded real options.

c. MAPPING VICHY DERCOS NEOGENIC GEL-FLUID AS AN INVESTMENT

In order to frame Vichy Dercos Neogenic's product development and launch as an investment decision – or multiple decisions – this Work Project builds around the following structure (Kang, 2009):

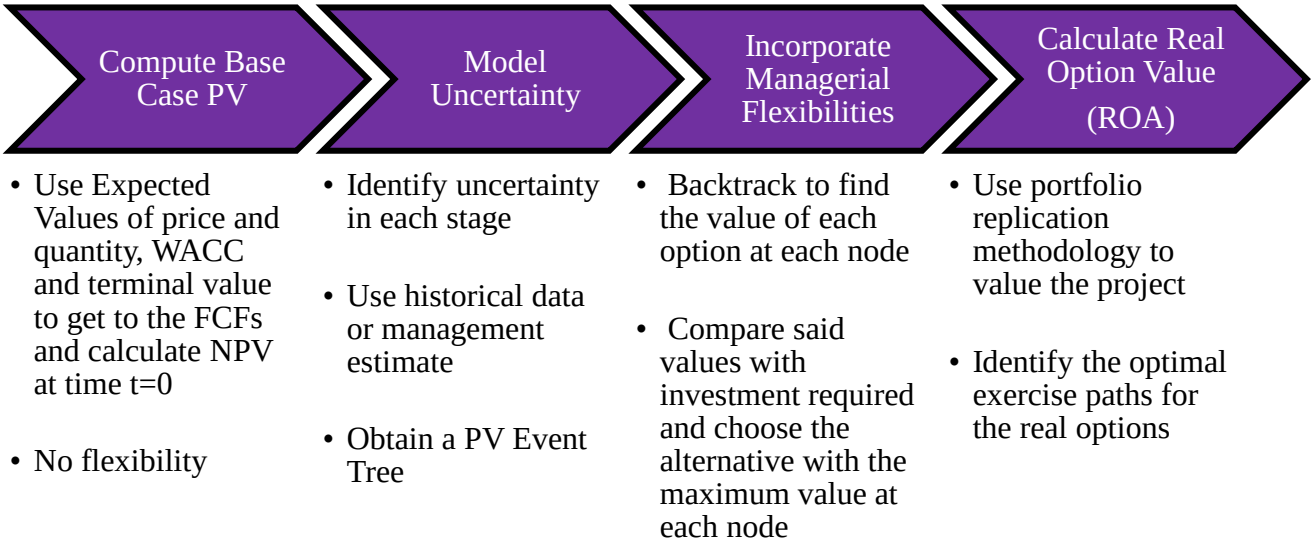


Figure 4 – ROA process from "Real Option Valuation of Product Innovation"

In terms of numbers however, since Vichy did not want to disclose any information, most values used for the computation of the ROA are merely fictional and only illustrative of how the reasoning and calculations should be performed.

i. Compute Base Case PV – No Flexibility

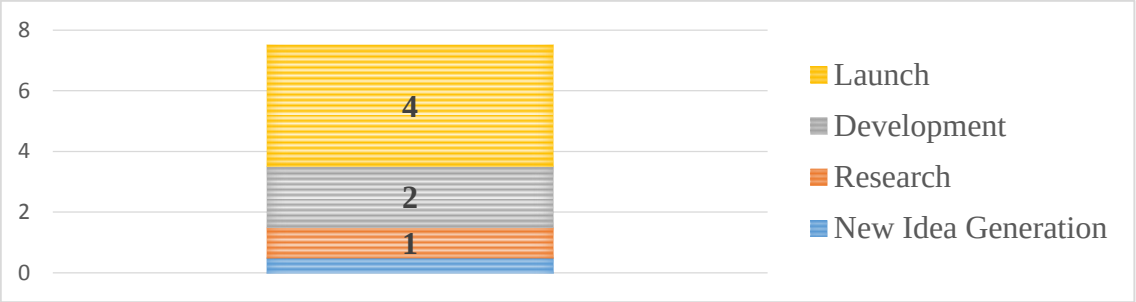
So as to calculate the Base Case PV, it is necessary to understand that there are two different moments to be considered. One moment of investment, within the company, when there are only cash outflows and which includes "New Idea Generation", "Research" and "Development". These cash flows must be discounted by using the risk-free rate since only the time value of money needs to be accounted for. In this case, a risk-free rate benchmark which could be used is the 5Y Italian Government Bonds, which has as of June 12th of 2015, a current yield of 0.7%. Even though this may seem like a low benchmark, it is a direct consequence of the low interest rates that the Eurozone has been subjected to and the most adequate one for the project at hand. For this reason and for simplification's sake, the annual risk-free rate used will be 1%. For the purposes of this case, each of the four phases will last 3 months – the risk free rate of each quarter being 0.25%. The second moment, after the product launch, is related to the market and all the cash flows from it should be discounted at the Weighted Average Cost of Capital. In this case, however, the approach was slightly different in the sense that all cash flows were discounted at the risk free rate, according to what the author displays in the book. A binomial tree approach was then used to account for market uncertainty, combined with portfolio replication methodology.

Another factor which must be portrayed is the possibility of not being able to generate new ideas, research or develop anything which is viable. As the phases get by, it becomes increasingly probable that a certain phase is successful. For the sake of this example, the likelihood of success of each stage in this case can be taken as follows:

Likelihood of…	New Idea Generation	Research	Development
Success	0.4	0.5	0.7
Failure	0.6	0.5	0.3

Table 1 – Likelihood of technological transfer success/failure

Also a necessary consideration, one must note that different levels of investment will be needed for each phase. This investment is growing phase after phase and must be considered when calculating the NPV. In this case, the values used were in million euro.



Graph 3 – Necessary investment per stage

As a further note, the 4 million euro "Launch" investment is a rough estimate of the cost of the Launch strategy which is outlined above, plus the cost of manufacturing.

Then, it is required to calculate the PV of sales, after the "Launch". For Vichy Dercos Neogenic, it can be assumed to be 30 million euro, even though once again the lack of information makes it very difficult to even test if this is a realistic number. Then, the NPV of the total project without flexibility must be calculated.

In this case, the NPV of the total project without flexibility is:

$$1) \qquad -0.5-\frac{1}{1+0.25\%}-\frac{2}{(1+0.25\%)^2}-\frac{4}{(1+0.25\%)^3}+\frac{30}{(1+0.25\%)^4}$$

This equals 22.24 million euro of NPV of the total project without flexibility. Looking strictly at this, without including uncertainty and the real options that show managers' flexibility, Vichy should go ahead with the project.

ii. Model Uncertainty

Kang then identifies in his book, two sources of uncertainty, linked to the product innovation process (Kang, 2009). The first one is technological uncertainty. It is assumed to be completely uncorrelated with market conditions, in this case, and decreases as the stages go by – see Table 1 – since more time spent researching and developing leads to diminished technological uncertainty. In every product innovation process, there is the possibility that the technology or concept at hand becomes unviable during "New Idea Generation", "Research" or "Development", as opposed to being successfully transferred to the next stage. If it fails to be transferred, the entire project must be terminated and no cash inflows are to be received from said project. If it succeeds in a certain phase, it goes on to the next one. On the other hand, product or market uncertainty is strictly tied to market conditions and it decreases with time, as the real demand for that product or technology becomes known. This source of uncertainty

includes demand – price and quantity – uncertainty, costs uncertainty, competitors' moves, macroeconomic conditions, etc. In order to quantify all this uncertainty, one can resort to historical data – assuming that the past can explain the future to some extent – or use subjective estimates provided by management. In the case of Vichy, since it is not possible to use historical data, the only solution is to make an educated guess. In the example, it is assumed that the expected cashflows after product launch can fluctuate up or down by 10% in a quarter due to overall product and market uncertainty.

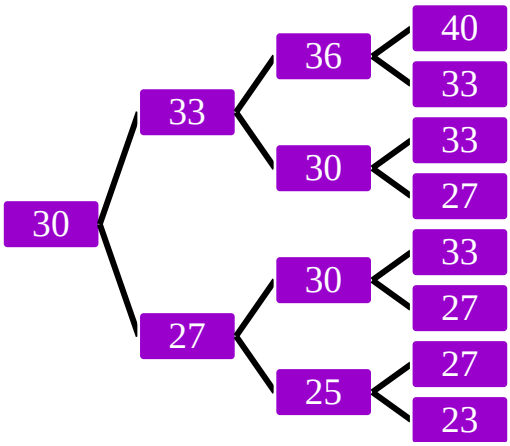


Figure 5 – PV event tree for product or market uncertainty

Having the PV event tree for the product and market uncertainty and the event tree for technological uncertainty for the Vichy case, it is now possible to start incorporating managerial flexibilities in the calculations. As a side note, it would be possible to estimate the volatility of this project and use a standard binomial model to generate the event tree. However, as Kang points out, in the case of technological uncertainty, since it does not follow a standard Brownian motion process and instead it gets significantly resolved at certain points in time, the best way to illustrate this is to keep the sources of uncertainty separate and to model their individual impact on the project's PV explicitly.

iii. Incorporate Managerial Flexibilities – Real Options

Upon building the necessary event trees, one must try to identify which managerial decisions can have an impact on the project's cashflows and overall value and at what point in time can these decisions take place.

Firstly, there is clearly the "option to delay" this investment. As in most projects, it is possible to delay it until more information becomes available. However, this may not be ideal due to competitors' moves, for example, who might choose to invest in that same

technology and would then enjoy a first-mover advantage. The second managerial flexibility is related to technological uncertainty and is an "option to abandon" if the technology is not successfully transferred to the following stage. The third managerial flexibility is the "option to expand". If the "Development" stage is successful, Vichy has the "option to expand" and to launch the product into the market. It could be argued that at every stage, Vichy is confronted with an "option to expand" vs an "option to abandon", with the exercise prices of the earlier being the necessary investment at each stage. After identifying these flexibilities, it is now possible to work the trees backwards in order to discover the NPV of each decision node. First, looking at technological uncertainty:

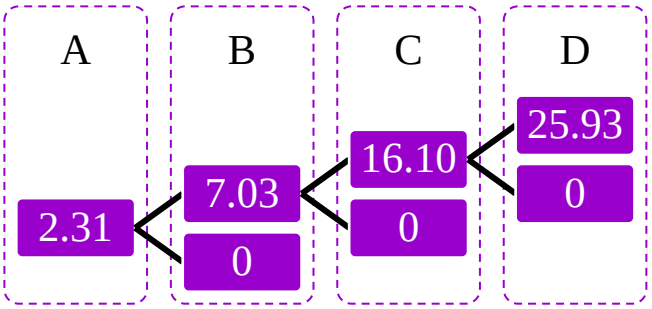


Figure 6 – Diagram to value project with technological uncertainty

The NPV in node D was computed by discounting the base case NPV (30 million euro) with the quarterly risk-free rate (0.25%) and then subtracting the investment of that particular phase (4 million euro). To compute the NPV at node C, one just needs to multiply the NPV at node D by the probability of success of "Development" (0.7), discount it one quarter and then subtract the 2 million euro investment for that stage. Working backwards, it is possible to arrive at an NPV with flexibility of 2.31 million euro. Given that the NPV without technological uncertainty or flexibility was 22.24 million euro, the value decreases by 19.93 due to the technological uncertainty impact.

Going on to product and market uncertainty, taking Figure 5 as the tree diagram for the underlying asset of this project – the PV of sales of Vichy Dercos Neogenic – one can structure a standard binomial tree approach to value this project.

u		**1.1**
d		0.909
T	Entire Project Time	0.75
n	Periods	3
t	Time-Step	0.25
q	Risk-Adjusted Probability	0.49
k	Strike Price at time T	7.51

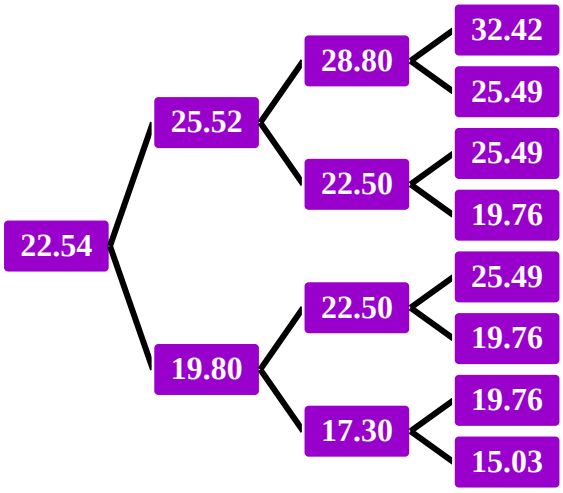


Figure 7 – Binomial tree to value project with product and market flexibility

By using the parameters on the table, it was possible to construct the diagram with the value of the option at each node. It was first necessary to determine the strike price at time T in order to obtain the payoffs in the latter stage of the tree. This was done by summing the future values of each investment that Vichy has to do for the product to be launched. Then this value was subtracted of the expected PVs. Upon getting these payoffs, the risk adjusted probability was calculated using u, d and the risk free rate of 0.25% per quarter. Then, to obtain the option value at time t=0, it was necessary to work backwards on the tree, always weighing the possible future payoffs with the risk adjusted probabilities and discounting these values appropriately. The result is that, at time t=0, this project is worth 22.54 million euro. As a side note, this binomial tree assumes that the technology transfer is successful at every stage, since it only models product and market uncertainty.

iv. Calculate Real Option Value

In the final step of the process, it is then possible to incorporate both sources of uncertainty and all managerial flexibilities to come up with an aggregate decision tree, allowing for a more accurate valuation of the real option at hand. Once again, this approach follows the one implemented by the author:

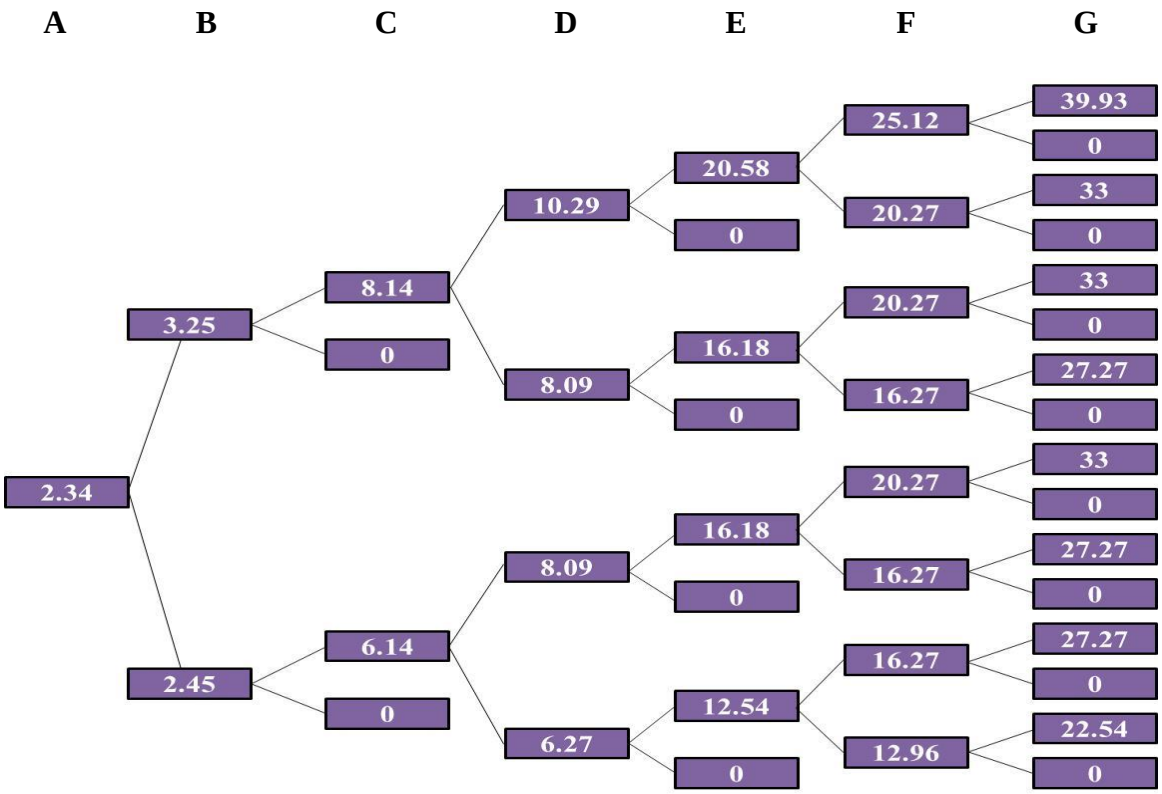


Figure 8 – Valuing the project accounting for uncertainties and real options

Node column G represents the cash inflow from product sales that Vichy will receive in case the product launch is successful, represented by a positive cash inflow, or in case it is a failure, no cash inflows. The values for the successful cases are those that were estimated in Figure 5, shown here with two decimals. Column F was computed by multiplying the probability of a successful technology transfer (0.7) times the payoff of the successful case (39.93, for example) net of the strike price of the launch stage (4) and discounted with the risk free rate for half a quarter (0.125%) since the diagram has two node columns per quarter. The result of this equation is 25.12.

For node column E, replicating portfolios of the underlying asset and a risk-free security were built (Antikarov, 2001) to value the outcomes that are resolved from market uncertainty in the cases where "Development" stage was successful. For all others, the NPV at that node is 0 and the project is abandoned.

$$2) \qquad m = \frac{(25.12 - 20.27)}{(27.95 - 23.10)} = 0.999 \qquad ; \qquad B = \frac{(25.12 - 27.95 * m)}{1 + \frac{0.25\%}{2}} = -2.793$$

The parameter m is obtained by dividing the results of node F by the corresponding values of the PV event tree multiplied by the success rate of the "Development" stage

(adjusted PV event tree), as shown by the author. And the B parameter is calculated by sorting out what position in risk free assets should one take to get a payoff of 25.12 when holding a 0.999 position on the underlying asset worth 27.95. By applying these parameters to 25.41, the corresponding value of the adjusted PV event tree, and subtracting the investment of the "Development" phase, one gets to the value of 20.58.

Repeating the procedure of discounting expected values of technological uncertainty to uncover node columns D and B and of building replicating portfolios based on the adjusted PV event tree to value nodes under C and A, it is possible to arrive at the value of 2.34 million euro as the value of the entire project including all managerial flexibilities and accounting for technological and product or market uncertainties. Given this result, Vichy should choose to go ahead with the project at every moment in time, as long as the technological transfer is successful.

As a final note, one can see that this result is strikingly similar to that of the NPV with flexibility on technological uncertainty. This is once again a proof that technological uncertainty is much more relevant – given the assumptions at hand – and therefore anchors the value of the option.

d. CURRENT SITUATION AND INVESTMENT DECISION

Nowadays, Vichy finds itself in the decision node column F, in the moment just prior to product launch and, implying that the data assumed somehow reflects the reality faced by the company, Vichy should go ahead with the product launch since all the NPV's of that column are positive.

In doing so, Vichy will hopefully leverage on some of the ideas presented in the context of the Business Project and do its best to maximize the PV of sales of the new Vichy Dercos Neogenic gel-fluid product.

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